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NATIONAL DAM INSPECTION PROGRAM. SHENANDOAH CREEK DAM (NDS ID N--ETC(U)
APR 80 R J KIMBALL DACW31-80-C-0020

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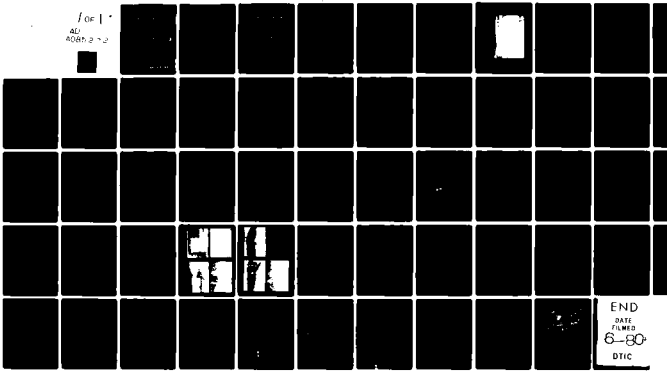

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SUSQUEHANNA RIVER BASIN

UNNAMED TRIBUTARY TO SHENANDOAH CREEK, SCHUYLKILL COUNTY

PENNSYLVANIA

SHENANDOAH CREEK DAM

NDS ID NO. PA-687

DER ID NO. 54-139

LEVEL II

BOROUGH OF SHENANDOAH

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

Prepared By

L. ROBERT KIMBALL & ASSOCIATES

CONSULTING ENGINEERS & ARCHITECTS

EBENSBURG, PENNSYLVANIA

15931

FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT CORPS OF ENGINEERS

BALTIMORE, MARYLAND

21203

APRIL, 1980

L. ROBERT KIMBALL & ASSOCIATES

DACW31-80-C-0020

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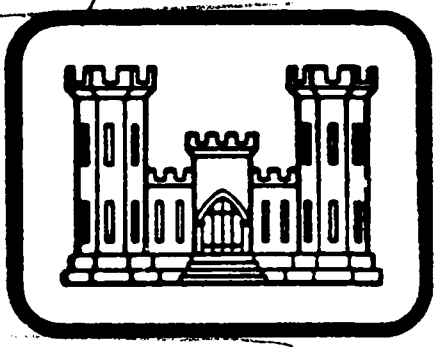
SUSQUEHANNA RIVER BASIN,
UNNAMED TRIBUTARY TO SHENANDOAH CREEK, SCHUYLKILL COUNTY,
PENNSYLVANIA

SHENANDOAH CREEK DAM

NDS ID Number PA-687,
DER ID NO. 54-139
Number

BOROUGH OF SHENANDOAH

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

APRIL 1980

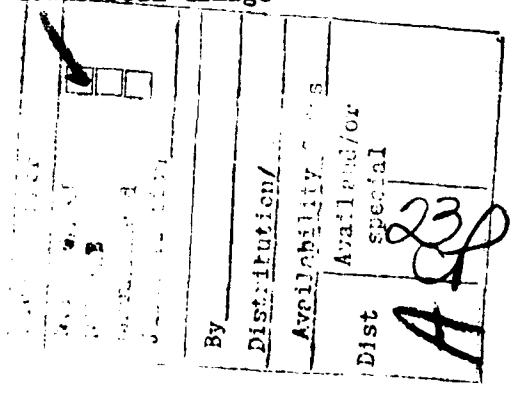
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Shenandoah Creek Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Schuylkill
STREAM	Unnamed tributary to Shenandoah Creek
DATE OF INSPECTION	November 5 and 16, 1979

ASSESSMENT

The assessment of Shenandoah Creek Dam is based upon visual observations made at the time of inspection, interviews with the owner and hydrologic and hydraulic analyses.

Shenandoah Creek Dam is a high hazard-small size dam. The recommended design flood for this dam is the 1/2 PMF to PMF. Based on the hazard and size classification of this dam and the downstream potential for loss of life the SDF for this dam is the PMF. The spillway and reservoir are capable of controlling the PMF. Based on criteria established by the Corps of Engineers, the spillway is termed adequate. The spillway and the outlet works gate tower are in a severely deteriorated condition and should be repaired.

The following recommendations and remedial measures should be instituted immediately.

1. All trees and brush should be cleared from the slopes, crest, spillway and spillway exit channel under the direction of a professional engineer knowledgeable in the design and construction of earth dams.

2. The outlet pipe should be located and the outflow should be evaluated by a professional engineer to establish the source of discharge and verify the integrity of the pipe.

3. The concrete gate tower should be repaired and made operable.

4. Repair the spillway weir and spillway retaining walls.

5. Exercise and lubricate valves on the outlet works gate tower.

6. Regular safety inspections should be conducted in accordance with provisions stipulated by the Commonwealth of Pennsylvania regarding the inspection of dams.

7. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

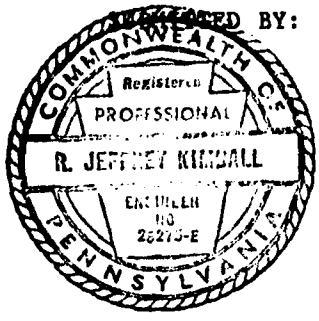
8. Improve access to the dam.

9. Provide access to the outlet gate tower.

SHENANDOAH CREEK DAM
PA-687

APPROVED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS



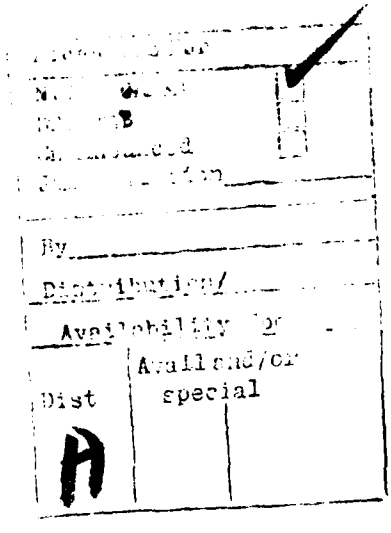
April 11, 1980
Date

R. Jeffrey Kimball
R. Jeffrey Kimball, P.E.

APPROVED BY:

16 May 1980
Date

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer



Overview of Shenandoah Creek Dam.

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APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM
SHENANDOAH CREEK DAM
NDI. I.D. NO. PA 687
DER I.D. NO. 54-139

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Shenandoah Creek Dam is an earth embankment, 34 feet high and 1,000 feet long, v-shaped with two embankments meeting at a right angle to form the dam. The crest width is 14 feet and both the upstream and downstream slopes are 2H:1V. A concrete cutoff wall 2 feet wide is founded on bedrock and extends three feet above the natural surface of the ground for the full length of the dam. The cutoff wall is in the center of a puddle core which is ten feet wide at the crest and twenty feet wide at the base. The remainder of the embankment, both upstream and downstream of the puddle core, consists of a random earth material. The upstream slope of the dam is surfaced for its full height with hand placed riprap laid over an 8 inch layer of gravel.

A six foot square reinforced concrete gate tower is located at the midpoint of the upstream slope in the angle between the two embankments. A 12 inch cast iron pipe encased in concrete extends from an intake at the upstream toe, into the tower and under the embankment to the downstream toe. Several concrete cutoff walls are placed along this pipe. The actual intake consists of a slotted flange on the end of an upturned flanged elbow. A 12 inch gate valve is located at the entrance of this pipe to the tower. A stem leads from the valve to the top of the tower. The reservoir drain discharges at the toe of dam.

The spillway is located at the left abutment and is formed by a concrete chute. The spillway exit channel, located beyond the toe of the left embankment, is constructed of hand placed stone walls.

b. Location. The dam is located on an unnamed tributary to Shenandoah Creek, approximately 1 1/4 miles northeast of the Borough of Shenandoah, Mahanoy Township, Schuykill County, Pennsylvania. Shenandoah Creek Dam can be located on the Shenandoah, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Shenandoah Creek Dam is a small size dam (34 feet high, 36 acre-feet).

d. Hazard Classification. Shenandoah Creek Dam is a high hazard dam. Downstream conditions indicate that a loss of more than a few lives is probable should the structure fail. Twenty-five hundred feet downstream of the dam the stream crosses a strip mine area and passes alongside the village of Yatesville. Several dwellings in Yatesville would be affected by failure of Shenandoah Creek Dam.

e. Ownership. Shenandoah Creek Dam is owned by the Borough of Shenandoah. Correspondence should be addressed to:

Connie Reese, Council President
Borough of Shenandoah
Borough Building
Shenandoah, PA 17976
(717) 462-1918

f. Purpose of Dam. Shenandoah Creek Dam was formerly used for water supply. The dam is currently inactive.

g. Design and Construction History. The available design data was obtained from the PennDER files. A summary of the design by PennDER is contained in their files. The dam was built during the period of 1934-1935. PennDER files contain several photographs of the dam immediately after construction was completed. No construction history exists.

h. Normal Operating Procedure. No operational procedures are in existence for this dam. The dam has been abandoned by the Borough of Shenandoah.

1.3 Pertinent Data.

a. Drainage Area. 0.11 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Unknown
Emergency spillway capacity at top of dam	743

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on pool elevation 1780 interpolated from U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1784.9
Top of dam - design height	1782.0
Normal pool	1780.1
Spillway crest	1780.1
Streambed at centerline of dam	1751.2
Tailwater	None
Toe of dam	1751.2

d. Reservoir (feet).

Length of maximum pool (PMF)	650
Length of normal pool	600

e. Storage (acre-feet).

Normal pool	22.5
Top of dam	44.3

f. Reservoir Surface (acres).

Top of dam	5
Normal pool	3.7
Spillway crest	3.7

g. Dam.

Type	Earthfill
Length	1000'
Height	34'
Top width	14'
Side slopes - upstream	2H:1V
- downstream	2H:1V
Zoning	Yes
Impervious core	Puddle core
Cutoff	Concrete cutoff wall
Grout curtain	None

h. Reservoir Drain.

Type	12" CIP
Length	Approximately 150'
Closure	Valve on gate tower
Access	None
Regulating facilities	Valve on gate tower

1. Spillway.

Type	Rectangular
Length of crest	22.8'
Crest elevation	1780.1'
Upstream channel	Lake
Downstream channel	600' open channel

SECTION 2
ENGINEERING DATA

2.1 Design. A design contained in the PennDER files prepared by PennDER summarizes the design of the dam. In addition to construction drawings, several photographs and inspection reports are available in the PennDER files. No design data was provided by the owner. Information on operation and maintenance was provided from discussions with the owner.

2.2 Construction. No information exists on the construction history of the dam.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. Availability. Some design data, construction drawings, photographs and inspections reports were provided by PennDER. A representative of the owner accompanied the inspection team to answer questions on any maintenance or operations conducted at the dam. The owner did not provide any design or construction data.

b. Adequacy. The information available is not sufficient to conduct a detailed engineering study. A Phase I report was completed based upon data obtained from the visual inspection, available data and hydrologic analysis, only.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Shenandoah Creek Dam was conducted by personnel of L. Robert Kimball and Associates on November 5 and 16, 1979 accompanied by a representative of the owner. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in fair condition. From a brief survey conducted during the inspection, it was determined that the low spot on the crest of the embankment is located at the angle between the two embankments. The crest width is 14 feet. The upstream slope is 2H:1V and covered with hand placed stone. The downstream slope was measured to be 2H:1V. The upstream slope, downstream slope and crest is extensively covered with trees. No seepage or obvious signs of instability were noted during the inspection.

The road leading into the dam site is in poor condition and should be improved.

c. Appurtenant Structures. The outlet conduit consists of a 12 inch cast iron pipe. This pipe discharges at the toe of dam. No discharge structure exists. The reinforced concrete gate tower is in an extremely deteriorated condition. In addition, several holes are located in the gate tower so that water discharges through these holes and down the gate tower and into the 12 cast iron pipe. This flow controls a normal runoff into the reservoir. During flood conditions the gate tower is inaccessible.

The spillway is located on the left abutment and is formed by a concrete chute. The concrete weir has deteriorated, significantly. The weir is 22.8 feet long. The concrete retaining walls forming the sides of the spillway have also deteriorated, considerably. The spillway exit channel is constructed with hand placed stone walls beyond the toe of the left embankment. The spillway and spillway exit channel contains numerous trees which may restrict flow.

d. Reservoir Area. The reservoir is covered mostly with timberland. The reservoir slopes are gentle and are not considered susceptible to massive landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel of the unnamed tributary to Shenandoah Creek is steep. Approximately 2500 feet downstream of the dam the stream crosses through an extensive strip mined area. Approximately 3000 feet downstream of the dam the stream passes near the village of Yatesville.

3.2 Evaluation. In general, the embankment appears to be in fair condition. The appurtenant structures appear to be in poor condition. The embankment and appurtenant structures are not maintained.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir water surface is controlled by a hole in the concrete gate tower. No operation or maintenance is conducted at the dam.

4.2 Maintenance of the Dam. No planned maintenance schedule exists. Maintenance of the dam is considered poor.

4.3 Maintenance of Operating Facilities. Maintenance of the operating facilities is considered poor. The owner's representative was unaware of the reservoir drain being opened in the recent past.

4.4 Warning System in Effect. At the time of inspection no system was in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered poor. There is no warning system in effect to warn downstream residents.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. The design summary prepared by PennDER in their files indicates that the spillway capacity is equivalent to 600 cubic feet per second. Because of the deterioration and lowering effect of the weir our calculations indicate that the spillway capacity is equivalent to 743 cfs.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. Visual Observations. The spillway concrete is in a severelydeteriorated condition and is not maintained. Heavy tree growth exists in the spillway and in the spillway exit channel.

A low spot was noted in the middle of the structure at the junction of the two embankments.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Initial water level in the reservoir is at 1780.1 (spillway crest).

2. The top of dam is the low point of 1784.9.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	402 cfs
Spillway capacity	743 cfs

a. Spillway Adequacy Rating. The recommended design flood for this dam is the 1/2 PMF to PMF. Based on the hazard and size classification of this dam and the downstream potential for loss of life the (SDF) for this dam is the (PMF). Based on the following definition provided by the Corps of Engineers, the spillway is rated as adequate as a result of our hydrologic analysis.

> Adequate - All high hazard dams in which the spillway can pass the SDF (PMF).

The spillway and reservoir are capable of controlling the PMF without overtopping the embankment. The computer printout of the hydrology is included in Appendix D.

5.4 Summary of Dam Breach Analysis. As a subject dam can satisfactorily pass the PMF without failure (based on our analysis) it was not necessary to perform the dam breach analysis and downstream routing of the flood wave.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No signs of erosion or seepage were noted on the embankment nor at the toe of the embankment during the inspection. A heavy growth of trees was present on the upstream slope, downstream slope and crest of the dam. These trees should be selectively removed from the slopes.

b. Design and Construction Data. No design data are available on the design and construction of the dam which would pertain to the stability of the structure. No stability analyses have been performed.

c. Operating Records. No operating records are maintained.

d. Post Construction Changes. No known post construction changes have been made to the dam.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in fair condition but poorly maintained. The appurtenant structures are in poor condition and are not maintained. The visual observations and hydrologic and hydraulic calculations indicate that Shenandoah Creek Dam's spillway is adequate. The spillway is capable of controlling the PMF without overtopping the earth embankment. No data is available on the construction of the dam. No stability analyses are known to have been performed on the dam. The spillway and outlet works control structure are in a very deteriorated condition and should be repaired.

b. Adequacy of Information. A detailed analysis of the structure cannot be made because of lack of detailed design or construction information.

c. Urgency. The recommendations suggested below should be implemented immediately. Sufficient information is available to complete a Phase I report.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required by a professional engineer knowledgeable in dam design and analysis.

7.2 Recommendations/Remedial Measures.

1. All trees and brush should be cleared from the slopes, crest, spillway and spillway exit channel under the direction of a professional engineer knowledgeable in the design and construction of earth dams.

2. The outlet pipe should be located and the outflow should be evaluated by a professional engineer to establish the source of discharge and verify the integrity of the pipes.

3. The concrete gate tower should be repaired and made operable.

4. Repair the spillway weir and spillway retaining walls.

5. Exercise and lubricate valves on the outlet works gate tower.

6. Regular safety inspections should be conducted in accordance with provisions stipulated by the Commonwealth of Pennsylvania regarding the inspection of dams.

7. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

8. Improve access to the dam.

9. Provide access to the outlet gate tower.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Shenandoah Creek Dam COUNTY Schuylkill STATE Pennsylvania ID# PA 687

TYPE OF DAM Earthfill dam HAZARD CATEGORY High

DATE(s) INSPECTION November 5&16, 1979 WEATHER Clear and warm TEMPERATURE 50°

POOL ELEVATION AT TIME OF INSPECTION 1780.0 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

James T. Hockensmith RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None noted	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment appears to be o.k. Low spot in center of dam embankment.	
RIPRAP FAILURES	None noted.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Heavy vegetation on the upstream slope, downstream slope and crest.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good with the exception of the concrete retaining wall separating the spillway and the embankment.	
ANY NOTICEABLE SEEPAGE	None noted.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None noted.	
INTAKE STRUCTURE	Severely deteriorated condition. Hole in outlet works control structure.	
OUTLET STRUCTURE	None.	
OUTLET CHANNEL	Steep and forested.	
EMERGENCY GATE	Valve on top of outlet works gate tower. Inaccessible during floods.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Severely deteriorated condition.	
APPROACH CHANNEL	Several trees in approach section.	
DISCHARGE CHANNEL	Open cut formed by stone walls. Heavy vegetation in discharge channel.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

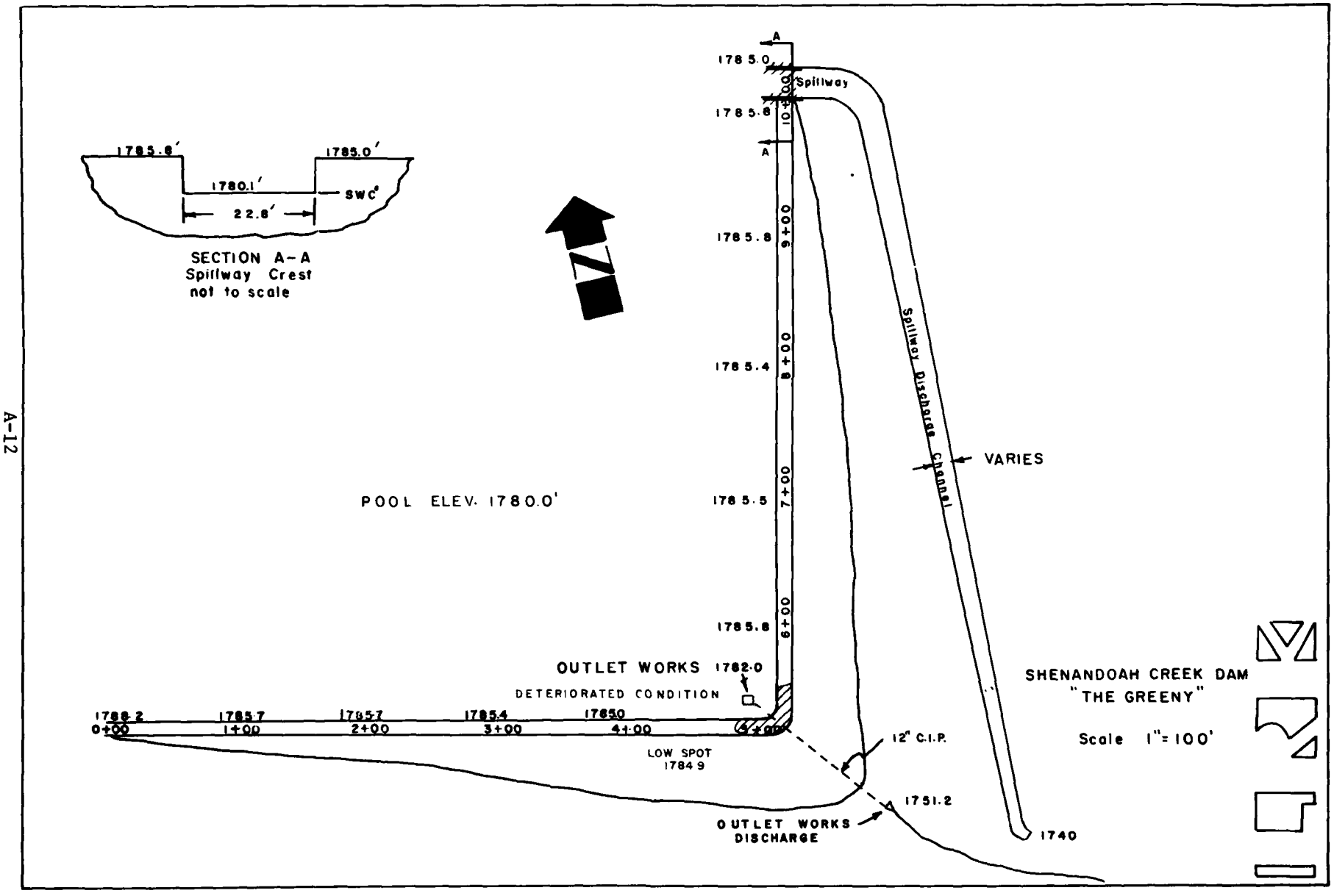
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Steep and forested. Approximately 3000 feet downstream is the village of Yatesville.	
SLOPES	Steep.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 4 homes - 16 people.	

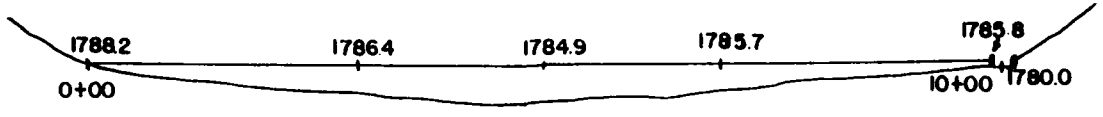
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle and stable.	
SEDIMENTATION	Did not appear excessive.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	


1785.6'
1785.0'
1780.1'
SWC
22.8'
SECTION A-A
Spillway Crest
not to scale
A
1785.0
Spillway
1785.6
A
1785.8
1785.4
1785.5
1785.8
POOL ELEV. 1780.0'
Spillway Discharge Channel
VARIES
OUTLET WORKS
DETERIORATED CONDITION
1782.0
1786.2
1785.7
1785.7
1785.4
1785.0
0+00
1+00
2+00
3+00
4+00
5+00
LOW SPOT
1784.9
12" C.I.P.
1751.2
OUTLET WORKS
DISCHARGE
1740
SHENANDOAH CREEK DAM
"THE GREENY"
Scale 1"=100'



PROFILE
LOOKING UPSTREAM

SHENANDOAH CREEK DAM
"THE GREENY"

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Shenandoah Creek Dam

ID# PA 687

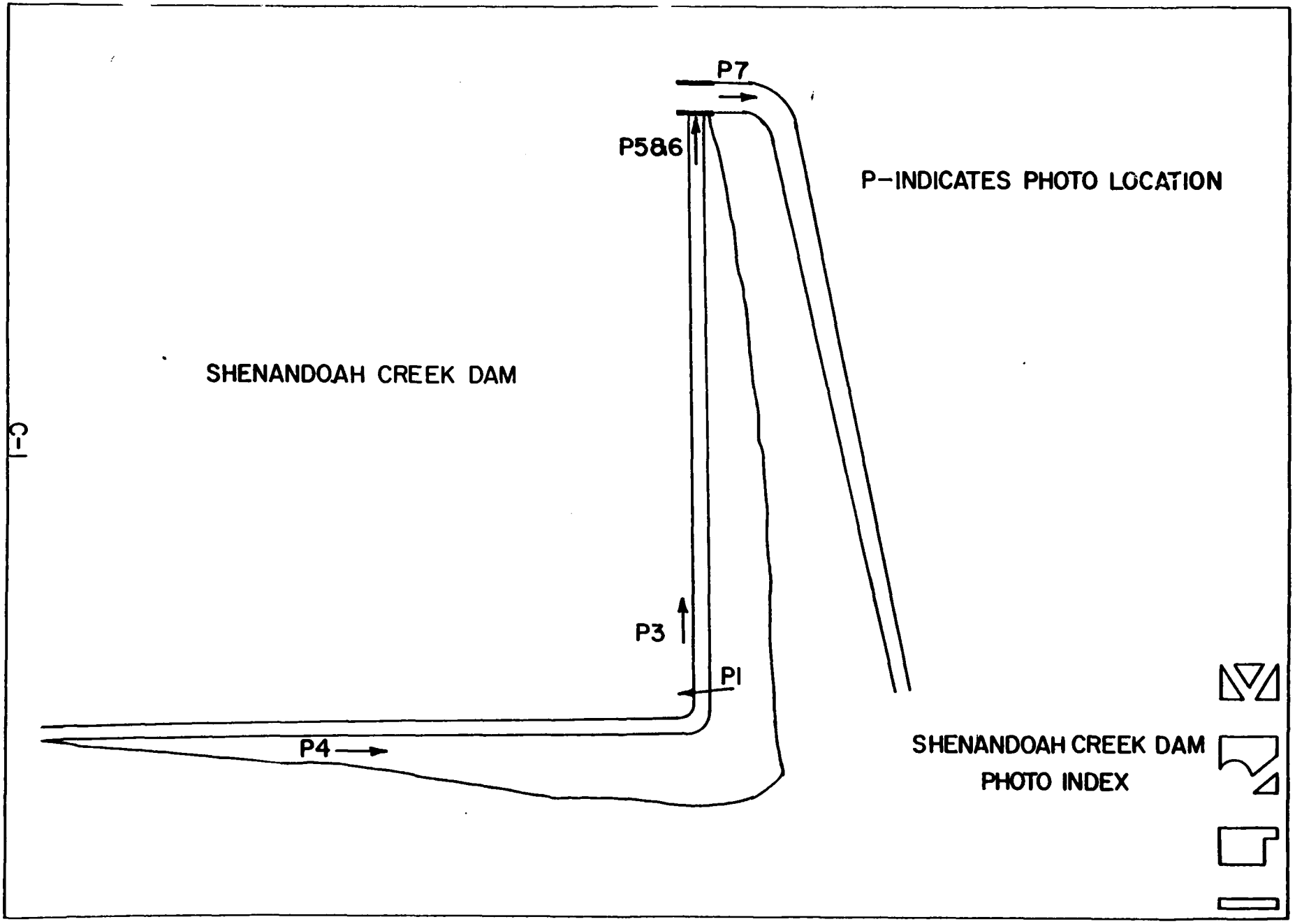
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	None.
TYPICAL SECTIONS OF DAM	On one construction drawing.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	On one construction drawing None. None. DER files. None.

ITEM	REMARKS
DESIGN REPORTS	Design report prepared by PennDER.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Boring logs on construction drawing.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	On construction drawing.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS


P7
P586
P-INDICATES PHOTO LOCATION
SHENANDOAH CREEK DAM
C-1
P3
P1
P4
SHENANDOAH CREEK DAM
PHOTO INDEX

SHENANDOAH CREEK DAM

Photograph Descriptions

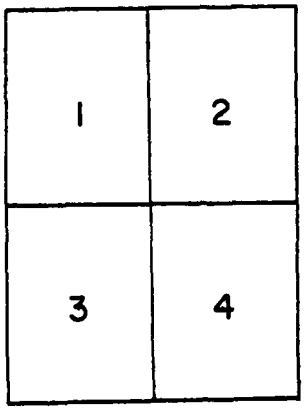
Sheet 1. Front

(1) Upper left - Deteriorated intake structure on outlet works.
(2) Upper right - Downstream exposure below Shenandoah Creek Dam.
(3) Lower left - Upstream slope of dam.
(4) Lower right - Heave growth on downstream slope.

Sheet 1. Back

(5) Upper left - Deteriorated spillway weir and vegetation.
(6) Lower left - Deteriorated spillway and spillway wall.
(7) Lower right - Heavy growth in spillway exit channel.

TOP OF PAGE



APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Shenandoah Creek Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (1.005) = 22.3 inches

STATION	1	2	3
Station Description	Shenandoah Creek		
Drainage Area (square miles)	0.11		
Cumulative Drainage Area (square miles)	0.11		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117		
12 hours	127		
24 hours	136		
48 hours	143		
72 hours			
Snyder Hydrograph Parameters			
Zone (2)	13		
Cp (3)	0.50		
Ct (3)	1.85		
L (miles) (4)	0.32		
Lca (miles) (4)	0.22		
tp = Ct(LxLca) 0.3 hrs.	0.83		
Spillway Data			
Crest Length (ft)	22.8		
Freeboard (ft)	4.8		
Discharge Coefficient	3.1		
Exponent	1.5		

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: DA-0.11 mi^2, wooded, mild slopes

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 22.5 ac-ft

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 44.3 ac-ft

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1784.9

SPILLWAY CREST:

a. Elevation 1780.1
b. Type Rectangular
c. Width 22.8'
d. Length 600' discharge channel
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 12" CIP
b. Location Junction of embankment wings
c. Entrance inverts Unknown
d. Exit inverts Unknown
e. Emergency draindown facilities 12" CIP

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1          A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
    2          A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF DAM SAFETY OF SHENANDOAH CREEK DAM
    3          A3       RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR TPA: 54=1391
    4          B   288       0      10       0       0       0       0       0       0       0
    5          B1    5
    6          J     1       2       1
    7          J1   .5       1
    8          K     0       1                                                       1
    9          K1       INFLOW TO RESERVOIR
   10          M     1       1    0.11                                                       1
   11          P            22.3     117     127     136     143
   12          T                                                                  1.0    0.05
   13          W  0.83    0.50
   14          X  -1.5    -.05     2.0
   15          K     1       2                                                       1
   16          K1       ROUTE
   17          Y                                       1       1
   18          YI    I                                                                =1780.1
   19          SS    0    22.5    44.3
   20          SE1766.1  1780.1  1785
   21          SS1780.1   22.8     3.1     1.5
   22          SD1784.9    3.0     1.5    1000
   23          K    99
```

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 80/04/03.
TIME= 12.50.59.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF DAM SAFETY OF SHENANDOAH CREEK DAM
RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR (PA. 54-139)

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	JPLT	JPRT	NSTAN
288	0	10	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS= .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.11	0.00	.11	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= .83 CP= .50 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.58 AND R= 6.53 INTERVALS

UNIT HYDROGRAPH 38 END-OF-PERIOD ORDINATES, LAG= .84 HOURS, CP= .50 VOL= 1.00

3.	12.	24.	35.	42.	43.	38.	33.	28.	24.
21.	18.	15.	13.	11.	10.	8.	7.	6.	5.
4.	4.	3.	3.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	402.	221.	67.	34.	9771.
CMS	11.	6.	2.	1.	277.
INCHES		18.66	22.83	22.95	22.95
MM		473.85	579.76	583.02	583.02
AC-FT		109.	134.	135.	135.
THOUS CU M		135.	165.	166.	166.

D-7

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1780.	0

CAPACITY=	0.	23.	44.
ELEVATION=	1766.	1780.	1785.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1780.1	22.8	3.1	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1784.9	3.0	1.5	1000.

STATION 2, PLAN 1, RATIO 1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2
				.50	1.00
HYDROGRAPH AT	1	.11	1	201.	402.
		(.28)		(5.69)	(11.39)
ROUTED TO	2	.11	1	182.	374.
		(.28)		(5.15)	(10.58)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1780.10	1780.10	1784.90
STORAGE	23.	23.	44.
OUTFLOW	0.	0.	743.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1781.98	0.00	31.	182.	0.00	40.83	0.00
1.00	1783.13	0.00	36.	374.	0.00	40.67	0.00

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME SHENANDOAH CREEK DAM
I.D. NUMBER 54-139
SHEET NO. 1 OF 2
BY O.T.M. DATE 4-3-80

LOSS RATE AND BASE FLOW PARAMETERS

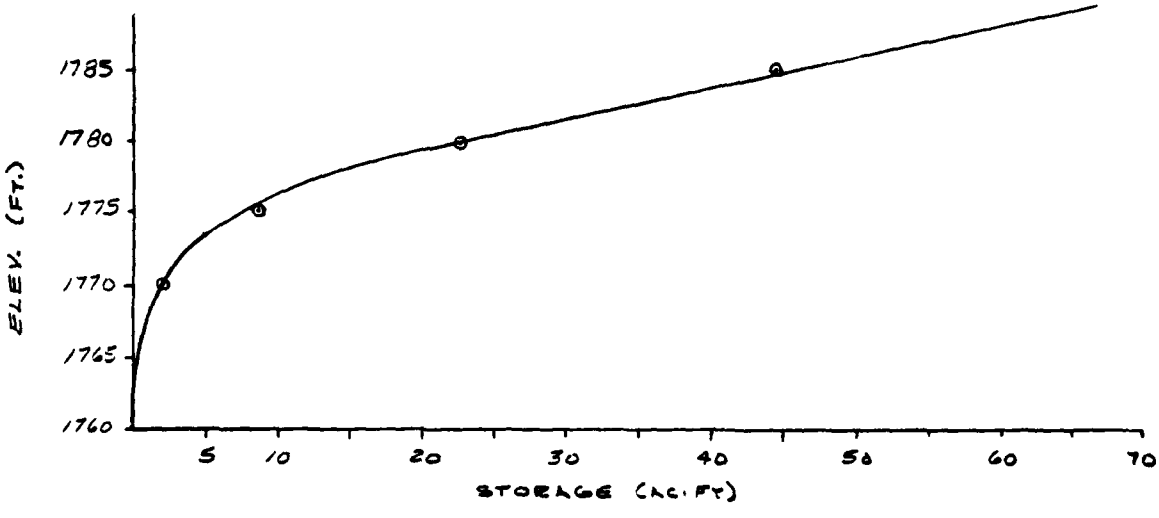
As Recommended By The Baltimore District C.O.E

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% of Peak Flow)
RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS

From U.S.G.S. 7.5-min. Quad., DER Files and Field Inspection Data.

At Spillway Crest Elev. = 1780.1'
Initial Storage = 22.5 Ac.Ft
Pond Surface Area = 3.7 Ac



$S	STORAGE (AC.FT)	0	1.8	8.7	22.5	44.3
$E	ELEVATION (FT)	1766.1	1770	1775	1780.1	1785

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME SHENANDOAH CREEK DAM
I.D. NUMBER PA. 54-139
SHEET NO. 2 OF 2
BY O.T.M. DATE 3/11/80

DISCHARGE RATING CURVE

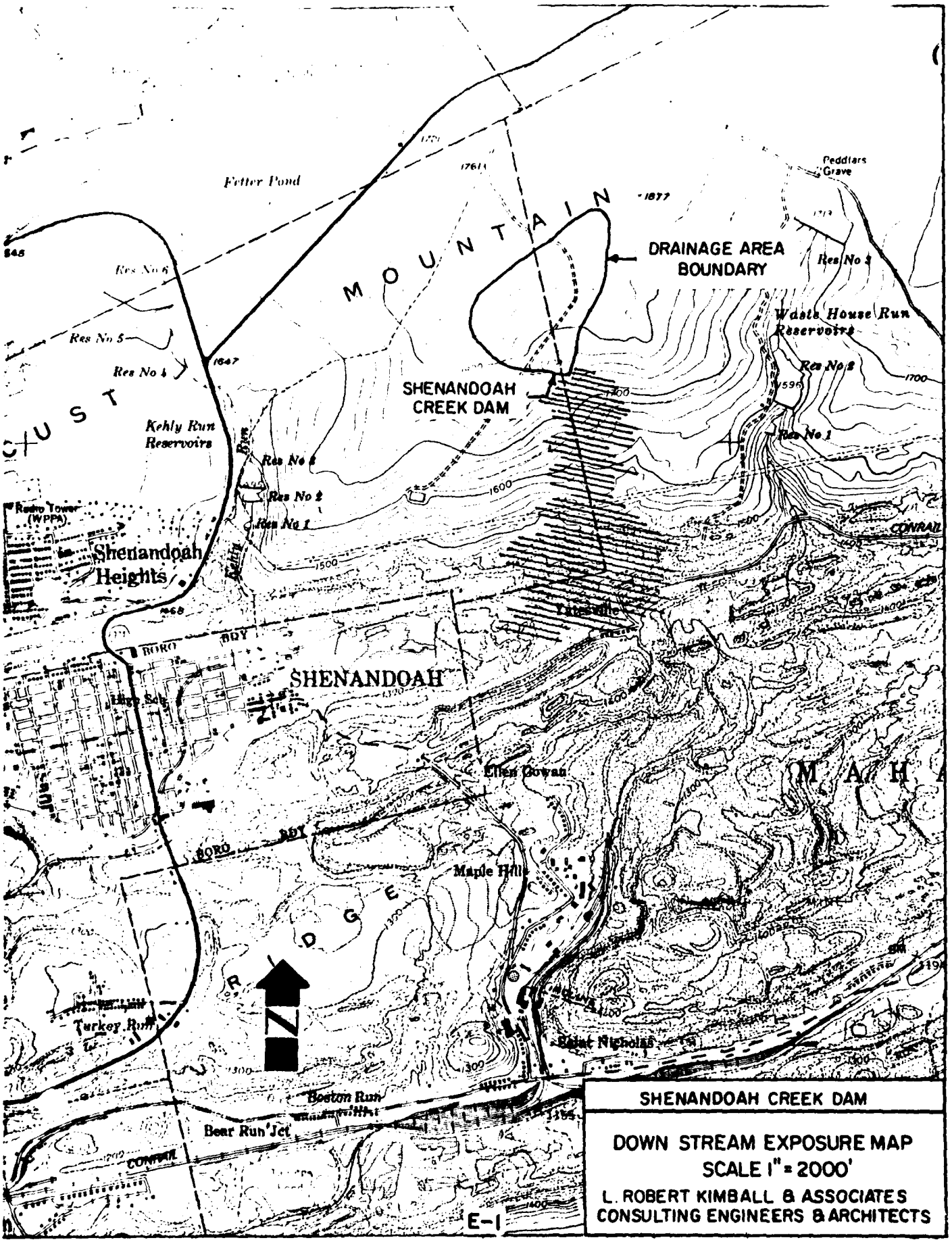
DETERMINED BY (HEC-1).

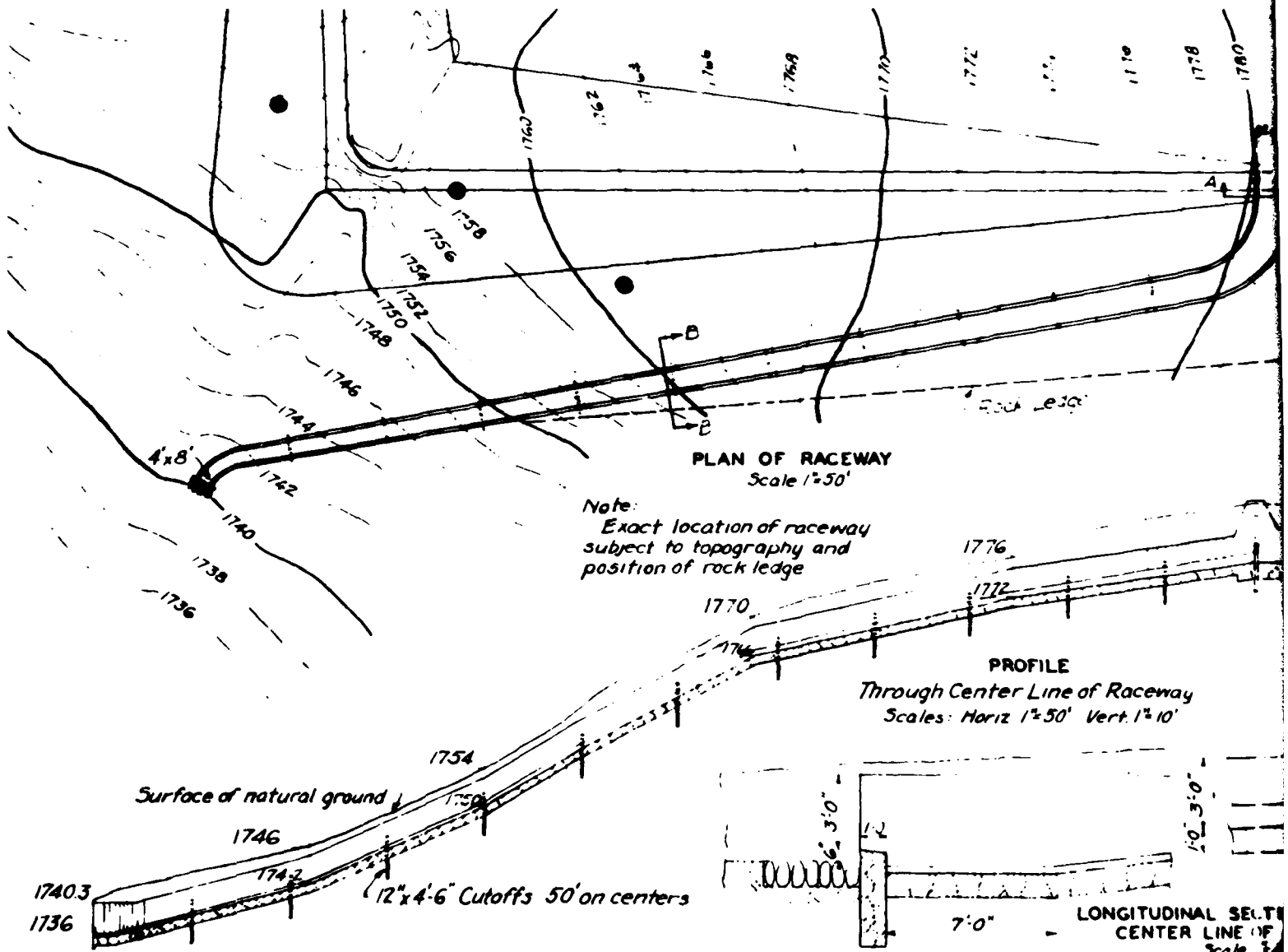
SPILLWAY CREST ELEV. = 1780.1'
WEIR LENGTH = 22.8'
COEFFICIENT OF DISCHARGE = 3.1 (BROAD CREST)

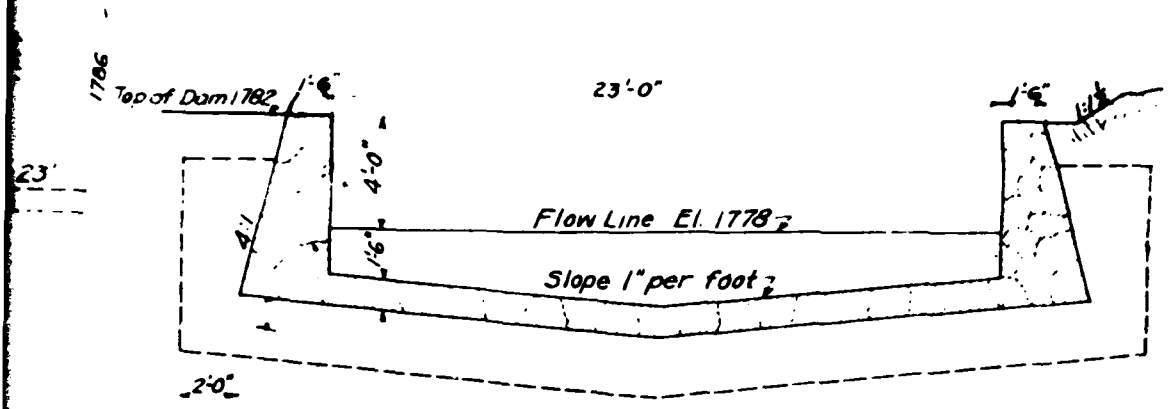
OVERTOP PARAMETERS

TOP OF DAM (LOW SPOT) = 1784.9'
LENGTH OF DAM (EXCLUDING SPILLWAY) = 1000'
COEFFICIENT OF DISCHARG = 3.0

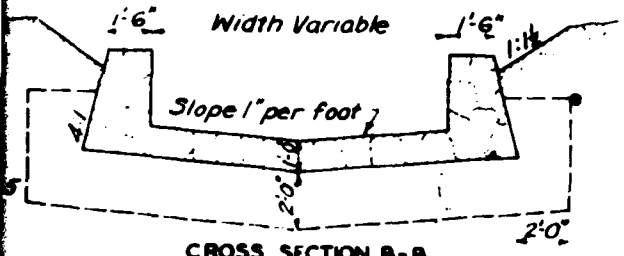
APPENDIX E
DRAWINGS


Fetter Pond
MOUNTAIN
DRAINAGE AREA BOUNDARY
Peddlers Grave
Res No 3
Wads House Run Reservoirs
Res No 2
Res No 1
SHENANDOAH CREEK DAM
Res No 6
Res No 5
Res No 4
Kehly Run Reservoirs
Res No 3
Res No 2
Res No 1
Radio Tower (WPPA)
Shenandoah Heights
SHENANDOAH
BORO BDY
Yatesville
CONRAIL
Ellen Gowan
Maple Hill
Saint Nicholas
Turkey Run
Boston Run
Bear Run Jct
E-1
SHENANDOAH CREEK DAM
DOWN STREAM EXPOSURE MAP
SCALE 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS


1760
1762
1764
1766
1768
1770
1772
1774
1776
1778
1780
1758
1756
1754
1752
1750
1748
1746
1744
1742
1740
1738
1736
A
B
B
4'x8'
PLAN OF RACEWAY
Scale 1"=50'
Note:
Exact location of raceway subject to topography and position of rock ledge
1776
1772
1770
PROFILE
Through Center Line of Raceway
Scales: Horiz 1"=50' Vert 1"=10'
1754
Surface of natural ground
1750
1746
1742
1740.3
1736
12"x4'-6" Cutoffs 50' on centers
3'-0"
3'-0"
7'-0"
LONGITUDINAL SECTI
CENTER LINE OF

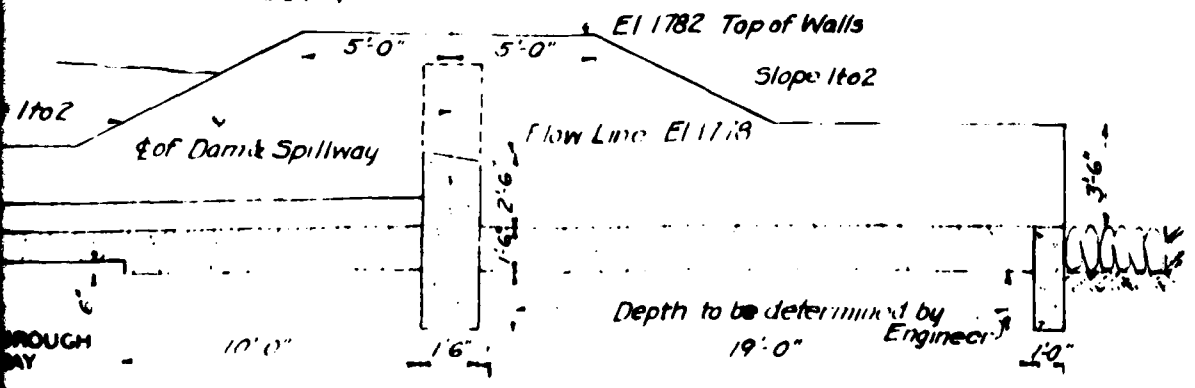


CROSS SECTION A-A
Scale 1"=4'



CROSS SECTION B-B
Scale 1"=4'

RACEWAY DETAILS
PROPOSED IMPOUNDING RESERVOIR
FOR
SHENANDOAH BOROUGH
SCHUYLKILL COUNTY, PA.
AUGUST 27, 1934 C. E. MYERS, C.E.
PHILADELPHIA, PA.



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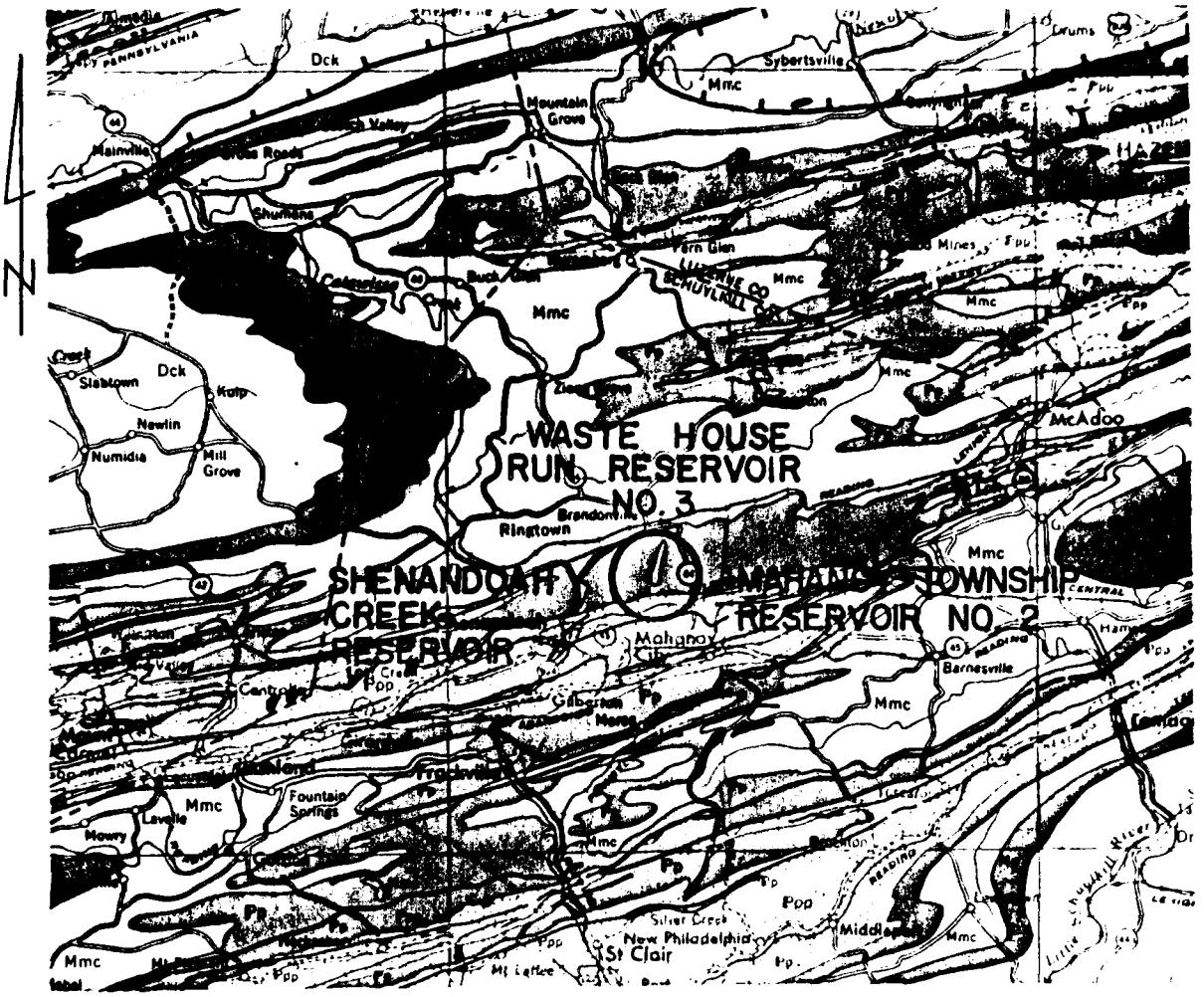
CONSULTING ENGINEERS & ARCHITECTS

APPENDIX F
GEOLOGY

General Geology

The Shenandoah Creek Dam is located in the Applachian Mountain section of the Valley and Ridge Physiographic Province. This area is characterized by tightly folded synclines and anticlines. The bedrock underlying the dam and reservoir is the Pennsylvanian-aged Pottsville Group. This formation consists of interbedded sandstone and conglomerate, medium to coarse grained; with some coal and dark shale. The bedding is usually moderately-well developed. Joints are fairly regular, abundant and steeply dipping. The rocks comprising this formation are moderately resistant to weathering and form a good foundation for heavy structures if excavated to sound material. Care should be taken where coal has been mined. Some faulting is eivdenced approximately two or three miles southeast and southwest of the reservoir.



GEOLOGIC MAP OF THE AREA AROUND SHENANDOAH CREEK, MAHANOY TOWNSHIP DAM NO. 2 AND WASTE HOUSE RUN NO. 3 RESERVOIRS

Pp — Pottsville Group

Light gray to white, coarse-grained sandstones and conglomerates with some interbedded [illegible]

Scale 1 : 250,000


FILMED
8